

### Amendments to the Claims

The claims have been amended as follows. Underlines indicate insertions and ~~strikeouts~~ indicate deletions.

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91 1. (Currently amended) A method of forming a hardened surface on a substrate, comprising:

providing a substrate; and

forming a metallic glass coating on the substrate, the forming comprising forming a successive buildup of continuous layers, the metallic glass coating ~~and~~ having a first hardness of at least about 9.2 GPa, and ~~wherein the metallic glass comprises~~ comprising an alloy containing fewer than 11 elements.

2. (Currently amended) A method of forming a hardened surface on a substrate, comprising:

providing a substrate;

forming a metallic glass coating on the substrate and having a first hardness of at least about 9.2 GPa, the metallic glass comprising fewer than 11 elements; and ~~The method of claim 1 further comprising~~ converting at least a portion of the metallic glass coating to a crystalline material having a nanocrystalline grain size and a second hardness of at least about 9.2 GPa

3. (Original) The method of claim 2 wherein the substrate is a metallic material.

4. (Original) The method of claim 2 wherein the substrate is a ceramic material.

5. (Original) The method of claim 2 wherein the first hardness is at least about 10.0 GPa.
6. (Original) The method of claim 2 wherein the metallic glass comprises fewer than 7 elements.
7. (Original) The method of claim 2 wherein the metallic glass coating is applied to the substrate as a plasma spray.
8. (Original) The method of claim 2 wherein the forming the metallic glass coating comprises an application of an atomized powder of a metallic glass material over the substrate.
9. (Original) The method of claim 2 wherein the forming a metallic glass coating comprises forming a successive buildup of continuous layers.
10. (Original) The method of claim 2 wherein the converting comprises heating the metallic glass to above a crystallization temperature of the metallic glass.
11. (Original) The method of claim 10 wherein the heating comprises heating to a temperature of at least about 600°C and below a melting temperature of the metallic glass.
12. (Original) The method of claim 2 wherein the second hardness is at least about 10.0 GPa.



13. (Original) A method of forming a hardened surface on a substrate, comprising:  
providing a substrate;

forming a metallic glass coating on the substrate; the metallic glass comprising one or more materials selected from the group consisting of  $(\text{Fe}_{0.85}\text{Cr}_{0.15})_{83}\text{B}_{17}$ ,  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{83}\text{B}_{17}$ ,  $(\text{Fe}_{0.75}\text{Cr}_{0.25})_{83}\text{B}_{17}$ ,  $(\text{Fe}_{0.6}\text{Co}_{0.2}\text{Cr}_{0.2})_{83}\text{B}_{17}$ ,  $(\text{Fe}_{0.8}\text{Cr}_{0.15}\text{Mo}_{0.05})_{83}\text{B}_{17}$ ,  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{C}_4$ ,  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{Si}_4$ ,  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{Al}_4$ ,  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Al}_4\text{C}_4$ ,  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Si}_4\text{C}_4$ ,  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Si}_4\text{Al}_4$ ,  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{71}\text{B}_{17}\text{Si}_4\text{C}_4\text{Al}_4$ ,  $(\text{Fe}_{0.7}\text{Co}_{0.1}\text{Cr}_{0.2})_{83}\text{B}_{17}$ ,  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{80}\text{B}_{20}$ ,  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{76}\text{B}_{17}\text{Al}_7$ ,  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{W}_2\text{C}_2$ ,  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{81}\text{B}_{17}\text{W}_2$ , and  $\text{Fe}_{64}\text{Ti}_3\text{Cr}_5\text{Mo}_2\text{B}_{16}\text{C}_5\text{Si}_1\text{Al}_2\text{La}_2$ ; and

converting at least a portion of the metallic glass coating to a crystalline material having a nanocrystalline grain size.

14. (Original) The method of claim 13 wherein the metallic glass coating is applied to the substrate by a plasma spray system.

15. (Original) The method of claim 13 wherein the forming the metallic glass coating comprises an application of an atomized powder of a metallic glass material over the substrate.

16. (Original) The method of claim 13 wherein the forming a metallic glass coating comprises forming a successive buildup of continuous layers.

17. (Original) The method of claim 13 wherein the metallic glass coating comprises  $(\text{Fe}_{0.85}\text{Cr}_{0.15})_{83}\text{B}_{17}$ .

18. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $(\text{Fe}_{0.85}\text{Cr}_{0.15})_{83}\text{B}_{17}$ .
19. (Original) The method of claim 13 wherein the metallic glass coating consists of  $(\text{Fe}_{0.85}\text{Cr}_{0.15})_{83}\text{B}_{17}$ .
20. (Original) The method of claim 13 wherein the metallic glass coating comprises  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{83}\text{B}_{17}$ .
21. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{83}\text{B}_{17}$ .
22. (Original) The method of claim 13 wherein the metallic glass coating consists of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{83}\text{B}_{17}$ .
23. (Original) The method of claim 13 wherein the metallic glass coating comprises  $(\text{Fe}_{0.75}\text{Cr}_{0.25})_{83}\text{B}_{17}$ .
24. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $(\text{Fe}_{0.75}\text{Cr}_{0.25})_{83}\text{B}_{17}$ .
25. (Original) The method of claim 13 wherein the metallic glass coating consists of  $(\text{Fe}_{0.75}\text{Cr}_{0.25})_{83}\text{B}_{17}$ .

26. (Original) The method of claim 13 wherein the metallic glass coating comprises  $(\text{Fe}_{0.6}\text{Co}_{0.2}\text{Cr}_{0.2})_{83}\text{B}_{17}$ .
27. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $(\text{Fe}_{0.6}\text{Co}_{0.2}\text{Cr}_{0.2})_{83}\text{B}_{17}$ .
28. (Original) The method of claim 13 wherein the metallic glass coating consists of  $(\text{Fe}_{0.6}\text{Co}_{0.2}\text{Cr}_{0.2})_{83}\text{B}_{17}$ .
29. (Original) The method of claim 13 wherein the metallic glass coating of comprises  $(\text{Fe}_{0.8}\text{Cr}_{0.15}\text{Mo}_{0.05})_{83}\text{B}_{17}$ .
30. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $(\text{Fe}_{0.8}\text{Cr}_{0.15}\text{Mo}_{0.05})_{83}\text{B}_{17}$ .
31. (Original) The method of claim 13 wherein the metallic glass coating consists of  $(\text{Fe}_{0.8}\text{Cr}_{0.15}\text{Mo}_{0.05})_{83}\text{B}_{17}$ .
32. (Original) The method of claim 13 wherein the metallic glass coating comprises  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{C}_4$ .
33. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{C}_4$ .

34. (Original) The method of claim 13 wherein the metallic glass coating consists of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{C}_4$ .
35. (Original) The method of claim 13 wherein the metallic glass coating comprises  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{Si}_4$ .
36. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{Si}_4$ .
37. (Original) The method of claim 13 wherein the metallic glass coating consists of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{Si}_4$ .
38. (Original) The method of claim 13 wherein the metallic glass coating comprises  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{Al}_4$ .
39. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{Al}_4$ .
40. (Original) The method of claim 13 wherein the metallic glass coating consists of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{Al}_4$ .
41. (Original) The method of claim 13 wherein the metallic glass coating comprises  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Al}_4\text{C}_4$ .

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42. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Al}_4\text{C}_4$ .
43. (Original) The method of claim 13 wherein the metallic glass coating consists of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Al}_4\text{C}_4$ .
44. (Original) The method of claim 13 wherein the metallic glass coating comprises  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Si}_4\text{C}_4$ .
45. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Si}_4\text{C}_4$ .
46. (Original) The method of claim 13 wherein the metallic glass coating consists of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Si}_4\text{C}_4$ .
47. (Original) The method of claim 13 wherein the metallic glass coating comprises  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Si}_4\text{Al}_4$ .
48. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Si}_4\text{Al}_4$ .
49. (Original) The method of claim 13 wherein the metallic glass coating consists of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{75}\text{B}_{17}\text{Si}_4\text{Al}_4$ .

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50. (Original) The method of claim 13 wherein the metallic glass coating comprises  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{71}\text{B}_{17}\text{Si}_4\text{C}_4\text{Al}_4$ .

51. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{71}\text{B}_{17}\text{Si}_4\text{C}_4\text{Al}_4$ .

52. (Original) The method of claim 13 wherein the metallic glass coating consists of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{71}\text{B}_{17}\text{Si}_4\text{C}_4\text{Al}_4$ .

53. (Original) The method of claim 13 wherein the metallic glass coating comprises  $(\text{Fe}_{0.7}\text{Co}_{0.1}\text{Cr}_{0.2})_{83}\text{B}_{17}$ .

54. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $(\text{Fe}_{0.7}\text{Co}_{0.1}\text{Cr}_{0.2})_{83}\text{B}_{17}$ .

55. (Original) The method of claim 13 wherein the metallic glass coating consists of  $(\text{Fe}_{0.7}\text{Co}_{0.1}\text{Cr}_{0.2})_{83}\text{B}_{17}$ .

56. (Original) The method of claim 13 wherein the metallic glass coating comprises  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{80}\text{B}_{20}$ .

57. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{80}\text{B}_{20}$ .





58. (Original) The method of claim 13 wherein the metallic glass coating consists of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{80}\text{B}_{20}$ .

59. (Original) The method of claim 13 wherein the metallic glass coating comprises  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{76}\text{B}_{17}\text{Al}_7$ .

60. (Original) The method of claim 13 wherein the metallic glass coating of claim 13 consists essentially of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{76}\text{B}_{17}\text{Al}_7$ .

61. (Original) The method of claim 13 wherein the metallic glass coating consists of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{76}\text{B}_{17}\text{Al}_7$ .

62. (Original) The method of claim 13 wherein the metallic glass coating comprises  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{W}_2\text{C}_2$ .

63. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{W}_2\text{C}_2$ .

64. (Original) The method of claim 13 wherein the metallic glass coating of claim 13 consists of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{79}\text{B}_{17}\text{W}_2\text{C}_2$ .

65. (Original) The method of claim 13 wherein the metallic glass coating of claim 13 comprises  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{81}\text{B}_{17}\text{W}_2$ .

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66. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{81}\text{B}_{17}\text{W}_2$ .

67. (Original) The method of claim 13 wherein the metallic glass coating of claim 13 consists of  $(\text{Fe}_{0.8}\text{Cr}_{0.2})_{81}\text{B}_{17}\text{W}_2$ .

68. (Original) The method of claim 13 wherein the metallic glass coating of claim 13 comprises  $\text{Fe}_{64}\text{Ti}_3\text{Cr}_5\text{Mo}_2\text{B}_{16}\text{C}_5\text{Si}_1\text{Al}_2\text{La}_2$ .

69. (Original) The method of claim 13 wherein the metallic glass coating consists essentially of  $\text{Fe}_{64}\text{Ti}_3\text{Cr}_5\text{Mo}_2\text{B}_{16}\text{C}_5\text{Si}_1\text{Al}_2\text{La}_2$ .

70. (Original) The method of claim 13 wherein the metallic glass coating of claim 13 consists of  $\text{Fe}_{64}\text{Ti}_3\text{Cr}_5\text{Mo}_2\text{B}_{16}\text{C}_5\text{Si}_1\text{Al}_2\text{La}_2$ .

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